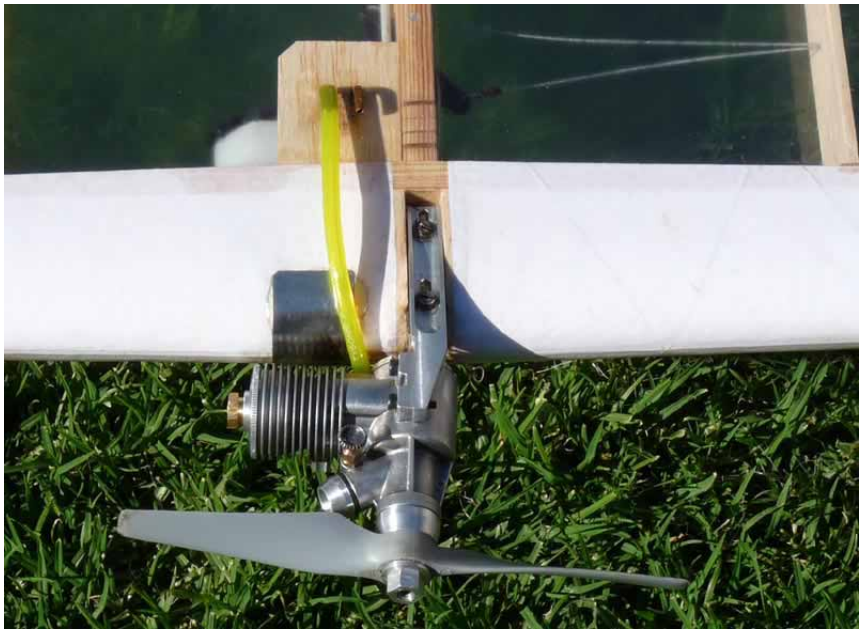
PARRA 2.5cc Diesel Engine Review

Tested by Maris Dislers

When the news reached us of a new 2.5cc diesel aimed at general control line applications and club-level competition work, we wasted no time in securing a PARRA 2.5 Diesel for evaluation. This is an initiative of Alberto Parra, who runs an Internet Shop for a range of Control Line equipment from the Canary Islands. Specific details can be accessed through the link given below.

http://www.clubtamaran.com/parramotorING.htm

Manufacture of Parra engines is undertaken in Ukraine and is currently limited to engines with “steel” piston/cylinder sets. An AAC version is undergoing development.



Parra 2.5 Diesel in a combat “Test Model”

Design and Construction

The PARRA’s front induction and side exhaust arrangement lends itself to a range of applications. Features such as a safety strap attachment point, short mixture needle and cupped prop driver are sure to appeal to combat users. However, the engine can also be used in racing and the “steel” setup conforms to the Spanish specification for F2F models. A regular Enya silencer can be attached, using a simple adapter plate, should noise be of concern. A variable speed carburettor is also available.

General construction follows orthodox practice. The one-piece crankcase is an aluminium alloy investment casting. It is threaded for the backplate and head retaining ring. The crankshaft has 12mm main journal diameter, stepping down to 6mm diameter and rides in two ball bearings. A standard M6x1 thread is used for the prop nut. The crankweb flanks are cut away either side of the crankpin, to counterbalance reciprocating mass. The machined aluminium conrod has a bronze bush fitted to its big end and has drilled lubrication holes.

The cylinder is of hardened steel, with tapered lower exterior profile, to aid gas flow to the three Schnuerle transfer ports. The cast iron piston is of lightweight design, having its lower skirt generously scalloped front and back. The upper edge of the sealing area is chamfered in the manner now accepted as good practice for such engines. The piston appears to have been heat treated before final finishing.

A push-pull cylinder head made of aluminium alloy is a nice touch and significantly enhances the engine’s performance and ease of use. Actual design harks back to that used for the FMV team racing engine by employing a short screw with left hand thread to link the compression screw and contra piston. This permits push-pull operation and the small contra piston diameter allows for very fine compression adjustment.

The head is retained by a threaded clamp ring against a group of copper gaskets. The number of gaskets can be altered to give coarse compression adjustment. It is recommended that optimum combustion chamber shape is with contra piston just a little recessed when adjusted for best running. Some trial and error with gaskets and other variables would of course be required. However, we had no need to alter the head position as set at the factory and a check after flight tests showed the contra-piston face recessed around 0.5mm. This is quite OK. The clamp ring has four holes to accept a pin-spanner. None is supplied with the engine or offered as an extra. However, spanners for Fora and other F2D engines are available and fit this engine.

The needle valve assembly has an angled nipple for fuel line attachment and a gland nut to maintain the mixture needle setting. This particular feature is in our opinion an improvement over the common practice with F2D engines of using a short compressed length of silicone tubing to retain the mixture setting. It does mean that the needle is somewhat more exposed to crash damage, but makes it easier to reach the needle when making adjustment. The coarse serrations on the needle’s thumb-wheel are perhaps the best we’ve seen for providing good grip, especially with the safer thumb-only

adjusting method.

The Parra is supplied with two venturi inserts, having 3.45mm and 4.45mm choke diameters. The smaller size conforms to the F2E Combat specification and would also be used for general purpose work involving aerobatics. The larger venturi is intended to give extra power at high running speeds, as in F2F or similar racing models. Actual venturi insert design follows the current practice of locating jet holes below the minimum choke point. To further direct the incoming fuel stream, the jet holes are inclined by 30 degrees towards the crankshaft.

The various port timing and duration “numbers” suggest that this engine has been specifically pitched at the multi-purpose role rather than outright power at the expense of flexibility. We measured the following;

Intake port opens 47 degrees ABDC

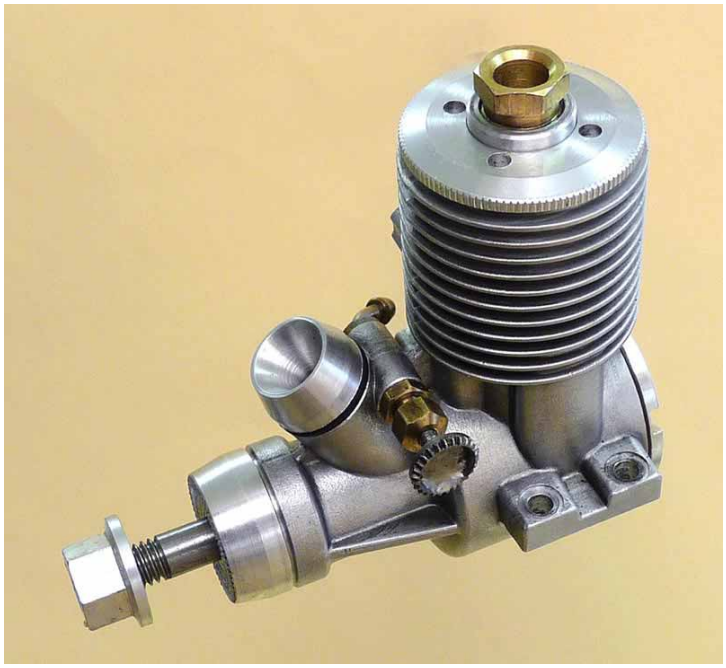
Intake port closes 32 degrees ATDS

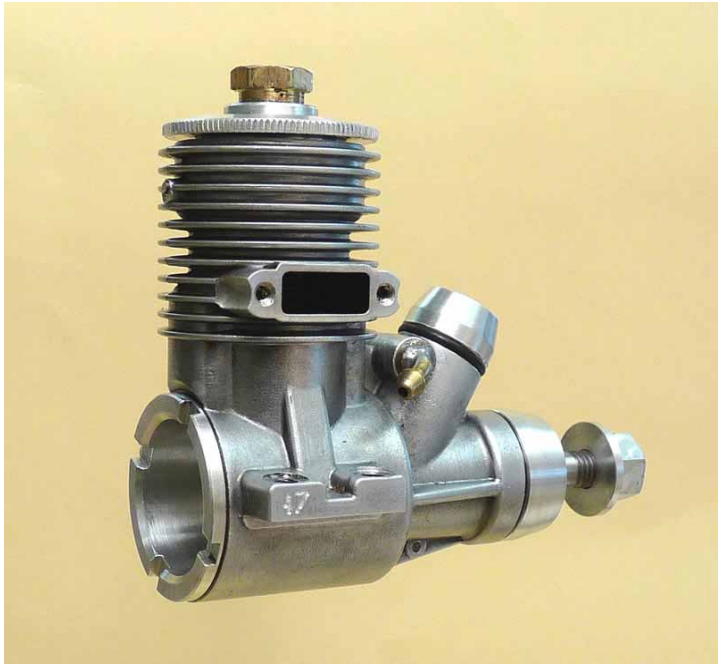
Intake duration 166 degrees

Transfer/boost port duration 124 degrees

Exhaust port duration 140 degrees

To summarise, a carefully thought out design that reduces weight and bulk where possible, but remains robust where it counts. Ours weighs 160g (5.6 oz). Aside from needing a pin-spanner to remove the head clamp ring, there are no exotic construction features to bamboozle the average owner. Fit and finish are of a fine standard.





Performance tests

Although the Web site boasts that the engine needs no more than a couple of tanks of fuel for running in, we gave the test engine over 30 minutes of prior running. In that time it was apparent that the engine really was essentially ready to go providing it was not pushed to its maximum potential too soon. By the end of this initial period, a nice grey sealing band had developed around the upper piston skirt, a good sign. The piston/cylinder fit deserves high praise, feeling “just right” both hot and cold.

The Parra responded well to normal starting protocol. Choking the carburettor was sufficient to prime the engine and we did not need to resort to exhaust primes. In the test stand it was easy to flood the crankcase, as it was not always clear whether the fuel feed gallery of the carburettor had been filled and the engine adequately primed. When flooded, a number of flicks were needed to clear the excess fuel. Even so, the engine did not “bite”, nor was it necessary to decrease compression if flooding occurred.

Starts were generally good, improving as lighter propeller loads allowed higher compression ratios to be set. On large propellers, it was best to increase compression somewhat for starting and initial warm-up, before decreasing it to a running setting. The Parra shows very good “heat tolerance” probably due to the aluminium cylinder head. So there is no need to set compression with a misfire. Conversely, it is also possible to innocently over compress the engine, which results in a tell-tale dark exhaust oil colour. Mixture setting is not critical. The Parra does not lose speed greatly on rich mixture settings, so the engine tester’s favourite “just lean crackle” is not needed to register top performance. General handling improved significantly when loaded with propellers that give peak or near-peek running speeds. Starting, warm-up time and response to adjustments were all at their best at higher running speeds. So to summarise, set compression up to peak, but keep the needle a little on the rich side.

Having completed our tests with the smaller venturi insert, the larger size was substituted. While our report gives RPM values at lower speeds and power increases are apparent, the engine was rather difficult to operate at low to moderate speeds, being very insensitive to mixture adjustment. This situation improves considerably at speeds approaching peak power output, being quite satisfactory for achieving improved straight-line airspeed.

Our results show peak torque with the small carburettor of 30 oz-in. at the lower end of the useable RPM range. This decreases relatively quickly as speeds increase. Peak power output of 0.4 BHP occurs around 16,000 RPM. This is about typical for engines of this type. Running with the larger carburettor boosts torque and reduces its decline across the useable speed range. Peak power rises to a little more than 0.45 BHP over a quite broad range, such that near-peak performance can be achieved anywhere between 15,000 RPM and 18,000 RPM. Beyond this level, vibration builds significantly.

Flight tests

We fitted the Parra to a Viko F2E combat model. The best starting technique was to point the carburettor downwards and choke it several times. Excess fuel can therefore freely drip out and the engine is sufficiently primed for starting within six flicks. The fuel tank feed position is considerably outboard of the carburettor, so a relatively rich mixture setting is needed on the ground. Never the less, the engine could be successfully warmed up without resorting to pinching the fuel line by pointing the nose vertically upwards.

Consistency of run was excellent. There was no appreciable difference between upright and inverted flight. Leaning out during tight turns was well within acceptable norms, allowing the engine to be set close to peak during level flight. We found that the Taipan 8x6 propeller gave lap times of 3.0-3.2 seconds per lap and is at the upper end of propeller load for this application. The Parra was happier with 7x6 propeller, showing improved lap times of 2.6-2.8 seconds. It was also noticeably more nimble in turns. We also tried a Taipan 8x4 nylon prop. Lap times increased to around 3.3 seconds, which is quite slow enough for speed-limit combat, which sets a maximum lap time of 3.5 seconds while towing a streamer. As expected, the engine was not able to “over-rev” sufficiently to make up for the one-third reduction in pitch. It is of course operating beyond the BHP peak and vibration is certainly noticeable. Despite initial fears, the dreaded fuel frothing problem that can plague diesel combat engines was absent.

Conclusion

We are told the Parra 2.5D has undergone extensive development by Spanish and Ukrainian flyers. Their efforts have certainly delivered an engine that is easy to use and really “works”. This is a welcome change to some recent experiences with engines that have been sold “off the plan”, but then need alteration to become truly effective, or require alteration from their intended purpose to suit the somewhat different control line club-competition role. Inevitably, the quite deliberate compromises in specification mean other similar 2.5cc diesel engines can boast higher peak power and torque levels on the test bench. Yet the Parra delivers its performance in a very practical no-fuss manner “out of the box” that supports its aim of being a modern substitute for those favourite 2.5 diesels of the past. Independent tests of three different engines fitted with APC 7x6 propellers, by three different users gave RPM values between 17,000 and 17,200 RPM. That suggests very good quality control. The Parra 2.5 diesel with “steel” piston/cylinder is sensibly priced at 110 Euros.

Propeller	RPM 3.5mm venturi	RPM 4.5 mm venturi
APC10x4	10300	
Graupner 9x5	11000	
APC 9x4	12600	13300
APC 8x6	13000	14000
Graupner 8x5	13200	13900
APC 8x4	15100	16300
Cox 8x4	14600	15300
APC 7x6	16000	17000
APC 7x5	16900	18100
APC 7x4	18200	19100
APC 7x3	19300